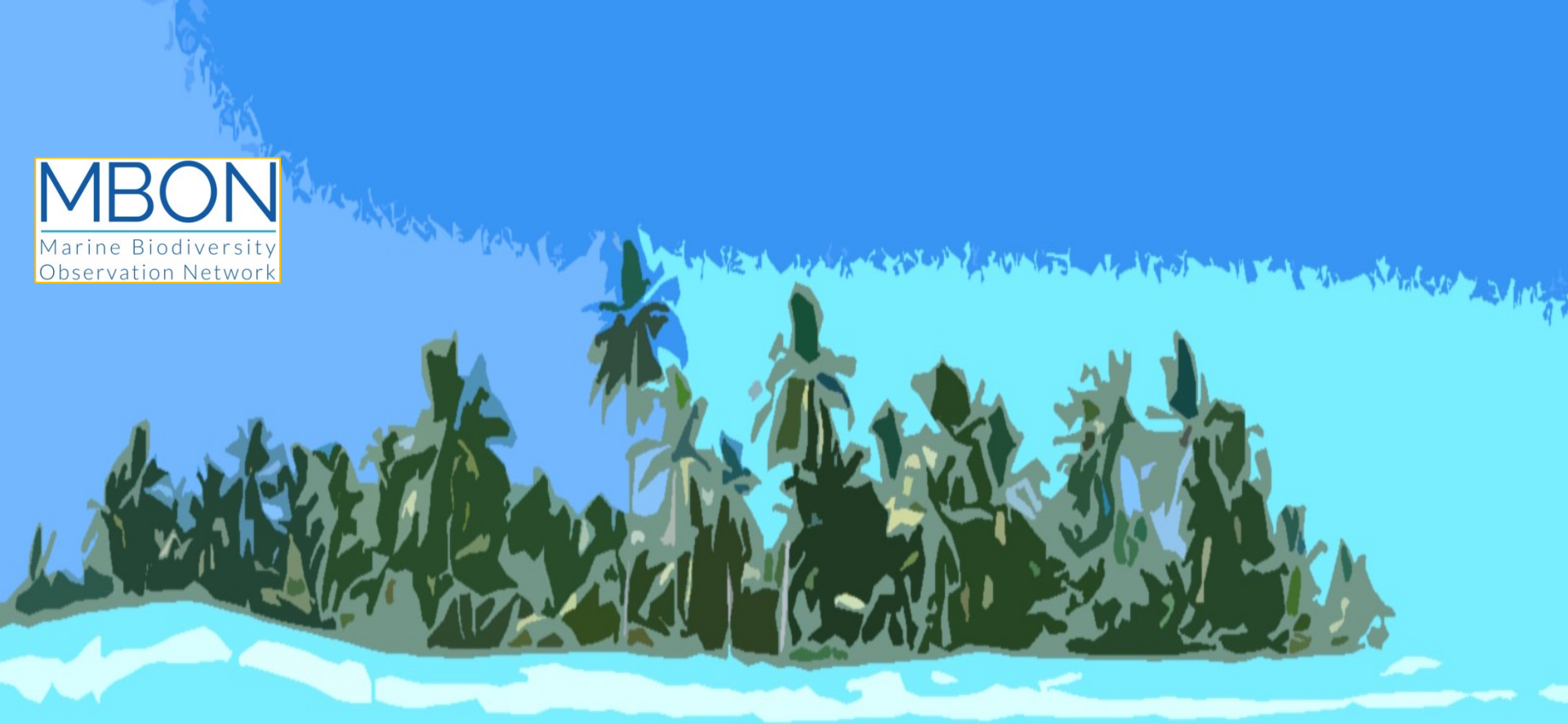
MBON

Marine Biodiversity Observation Network

Principal Investigators:
Frank Muller-Karger (USF)
Maria Kavanaugh, Robert Cowen (OSU)
Francisco Chavez (MBARI)
Robert Miller (UCSB)
Jeffrey Runge (UMaine)
Katrin Iken (UAF)
Enrique Montes (USF)
Emmett Duffy (SI)

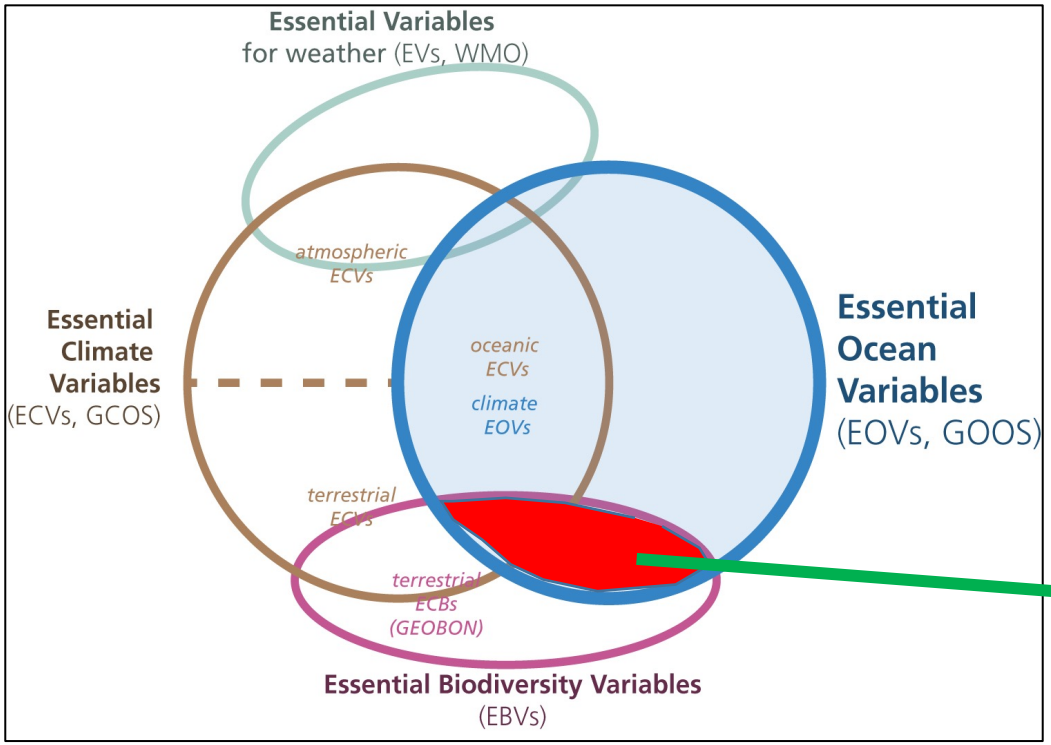


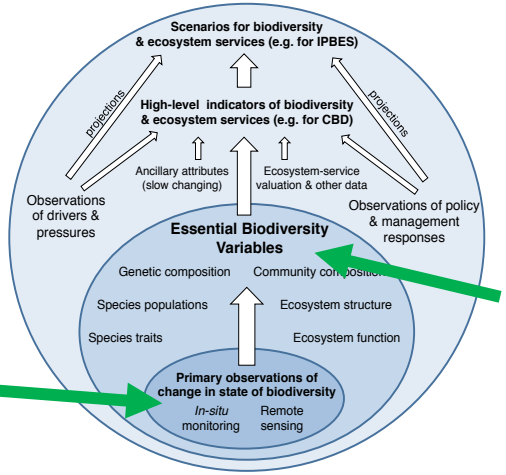
MBON
Marine Biodiversity Observation Network

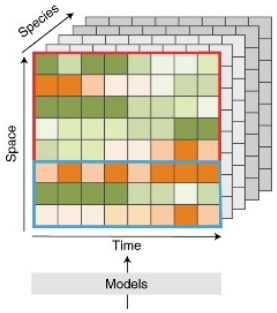
Huge investments have gone into ocean observing systems —
But there is still no systematic effort to observe life in the sea

MBON Goal: Enable the effort to characterize how marine biodiversity is changing and how it affects us

Essential Variables







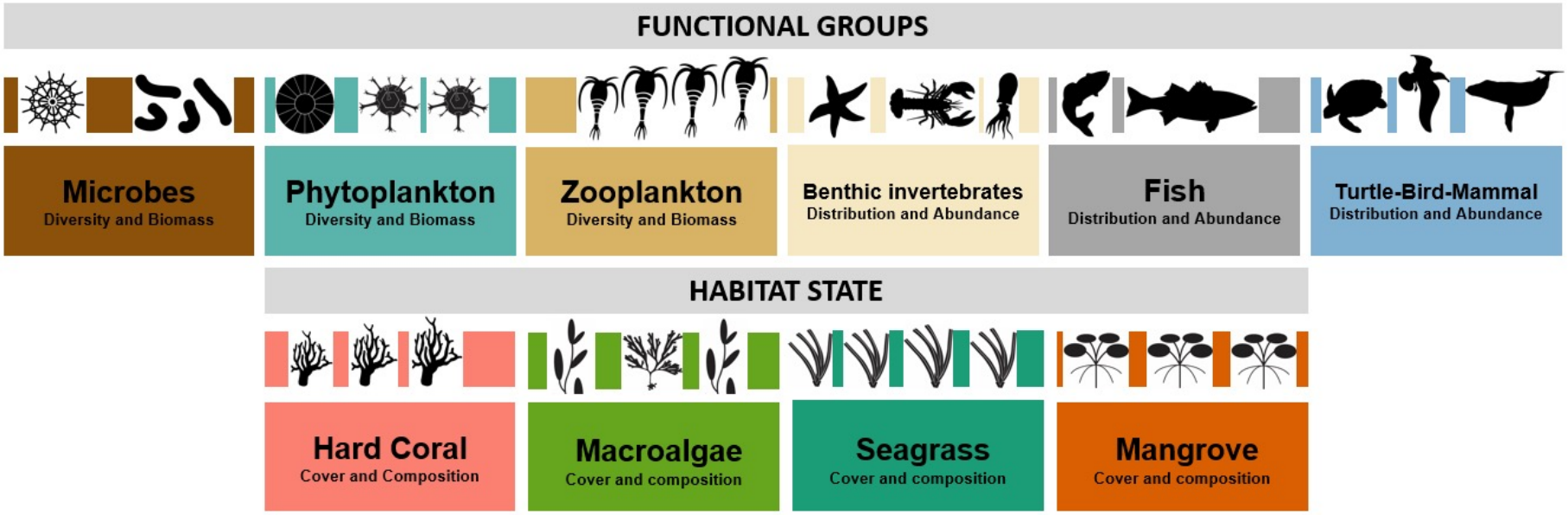
EBVs are not measured.
They are derived (multidimensional data 'cubes')

Pereira et al. (2013)
GEO BON EBVs

Framework for Ocean Observing (2012)
Global Ocean Observing System (GOOS)
Essential Ocean Variables (EOVs)

EOVs are the primary observations needed to model and build the EBVs (multidimensional data cubes)

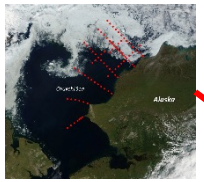
Biology and Ecosystem Essential Ocean Variables (EOVs)



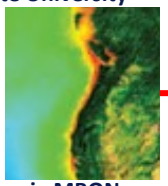
MBON

Marine Biodiversity Observation Network

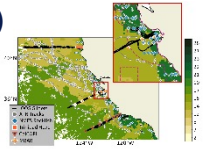
Arctic MBON / PI: Katrin Iken
University of Alaska, Fairbanks



Northern California Current MBON
PIs: Maria Kavanaugh, Robert Cowen
Oregon State University



Central California MBON
PI: Francisco Chavez
(MBARI)



Southern California Bight MBON
PI: Robert Miller
UC Santa Barbara

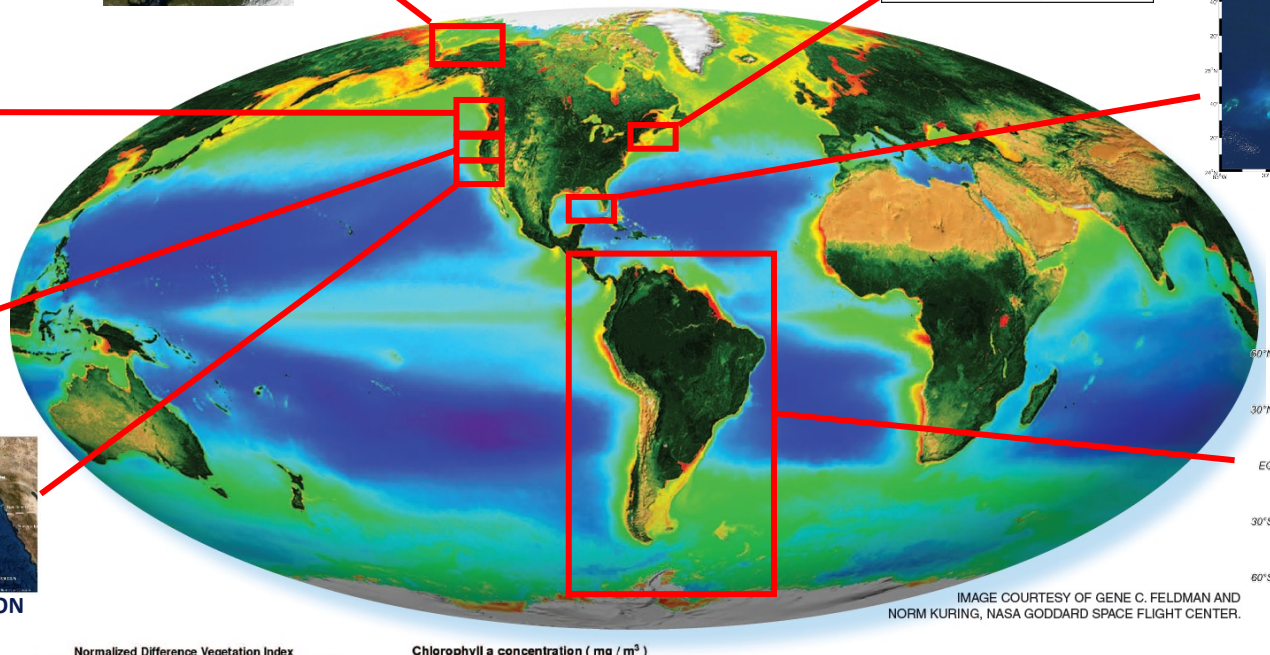
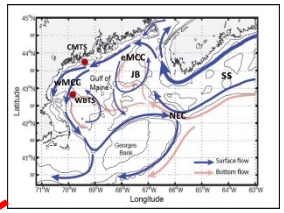
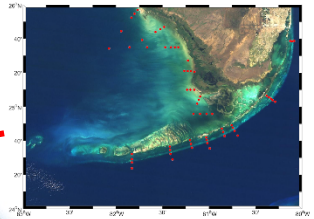


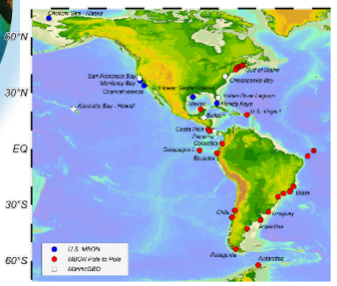
IMAGE COURTESY OF GENE C. FELDMAN AND NORM KURING, NASA GODDARD SPACE FLIGHT CENTER.

Gulf of Maine MBON
PI: Jeffrey Runge
University of Maine





South Florida MBON
PI: Frank Muller-Karger
University of South Florida



MBON Pole to Pole
in the Americas
PI: Enrique Montes

http://marinebon.org

Satellite-derived
Chlorophyll distribution

MBON
Marine Biodiversity Observation Network

GEO BON

Intergovernmental Oceanographic Commission

GOOS Biology and Ecosystems Panel

OBIS OCEAN BIODIVERSITY INFORMATION SYSTEM

Ocean Best Practices

Intergovernmental Oceanographic Commission IOC-UNESCO

Asia-Pacific MBON Secretariat
Massa Nakaoka / Take Yamakita
U Hokkaido / JAMSTEC

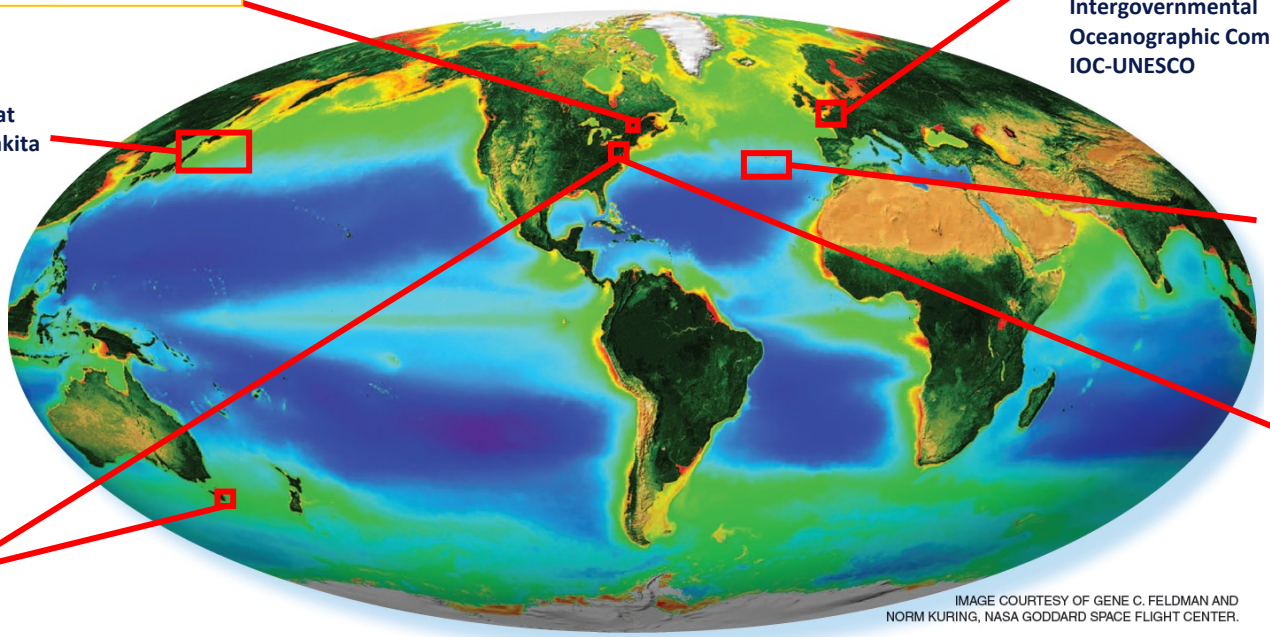


IMAGE COURTESY OF GENE C. FELDMAN AND NORM KURING, NASA GODDARD SPACE FLIGHT CENTER.

AIR CENTRE

MBON Secretariat
Joana Soares / Alice Soccodato
AIR Centre – Azores / Portugal

AmeriGEOSS

BLUE PLANET Oceans and Society

GOOS Biology and Ecosystems Panel

GOOS Bio-Eco
USA / Australia

http://marinebon.org

Marine Life 2030

2021 2030 United Nations Decade of Ocean Science for Sustainable Development

Satellite-derived Chlorophyll distribution

Evolving technology matrix

	Microbes/ Phyto	Zooplankton	Fish	Top Predators	Benthos, habitat forming
Optics/Imaging	X	X	X Benthic		X
Animal tracking (satellite, underwater)			X	X	
Acoustics		X active	X Active, passive	X Tags, passive	X Active, passive (noise)
Genomics	X	X	X	X	X
Platforms with samplers	AUVs, floats, moorings, satellites	AUVs, moorings	AUVs, moorings	AUVs, moorings, tags	AUVs, moorings, satellites
Data and visualization	X	X	X	X	X

THE OFFICIAL MAGAZINE OF THE OCEANOGRAPHY SOCIETY

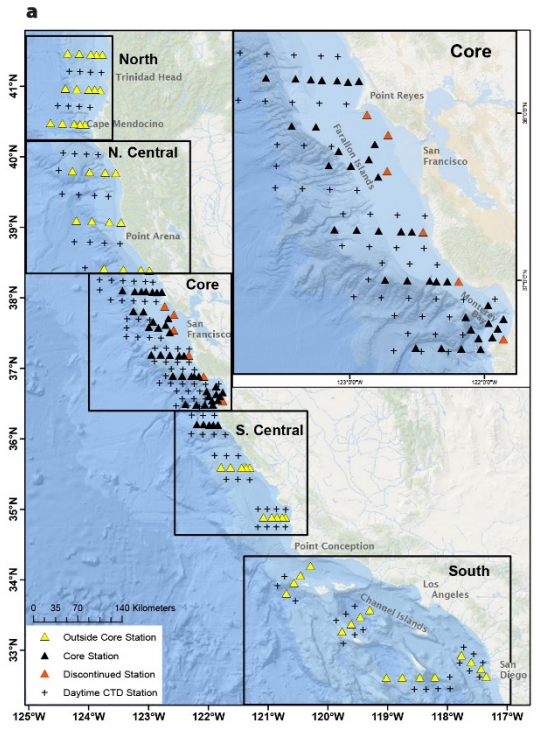
Oceanography

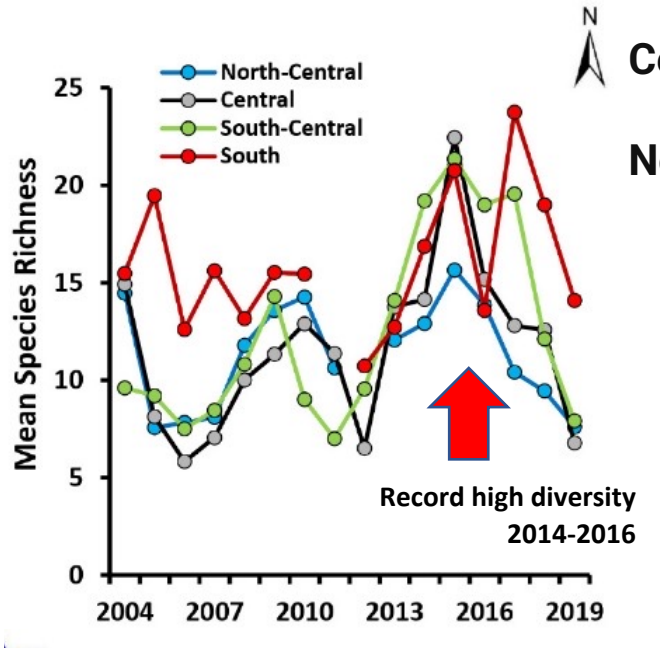
VOL.34, NO.2, JUNE 2021

MBON

MARINE BIODIVERSITY OBSERVATION NETWORK

AN OBSERVING SYSTEM FOR LIFE IN THE SEA

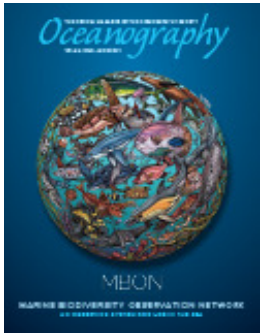




Southern California Bight MBON

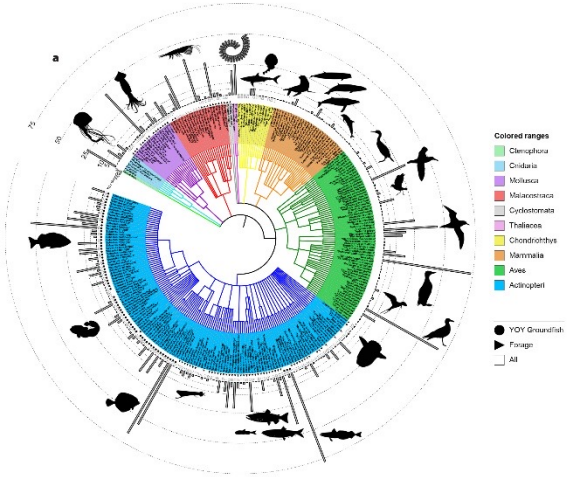
Central California MBON

Northern California Current MBON



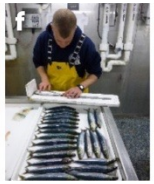
Santora et al., 2021
https://doi.org/10.5670/oceanog.2021.212

Kavanaugh et al., 2021

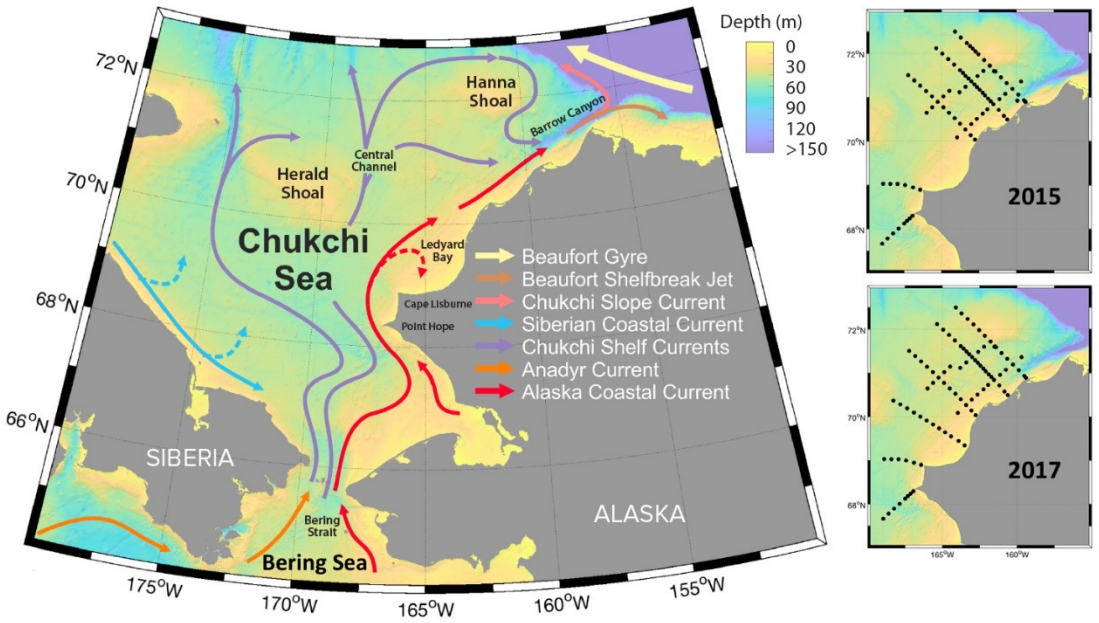


Finding:

- **Record high diversity in 2014–2016**
- **N Pacific heatwave compressed upwelling habitat** against the coast



Arctic Marine Biodiversity Observing Network (AMBON)



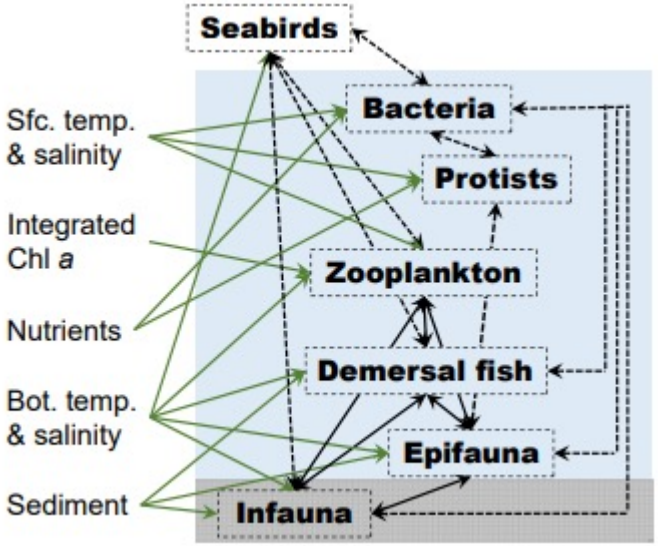
Mueter et al., 2021
https://doi.org/10.5670/oceanog.2021.213

Finding:

Borealization of the Chukchi Sea Shelf

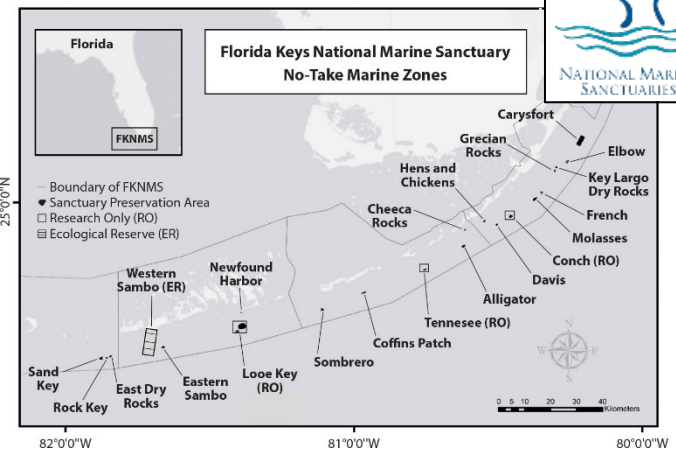
Northward expansion of predators:

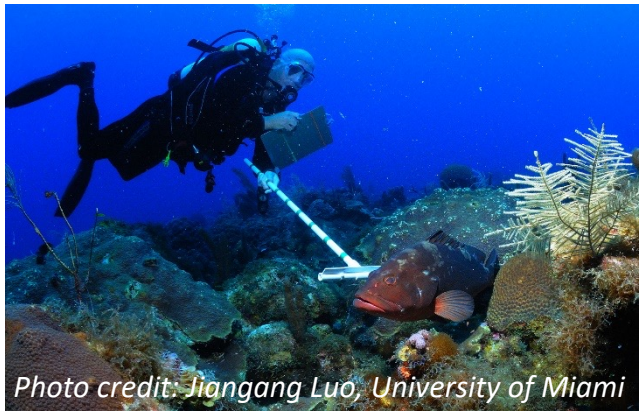
- demersal fish and large invertebrates
- reorganization of benthic food web

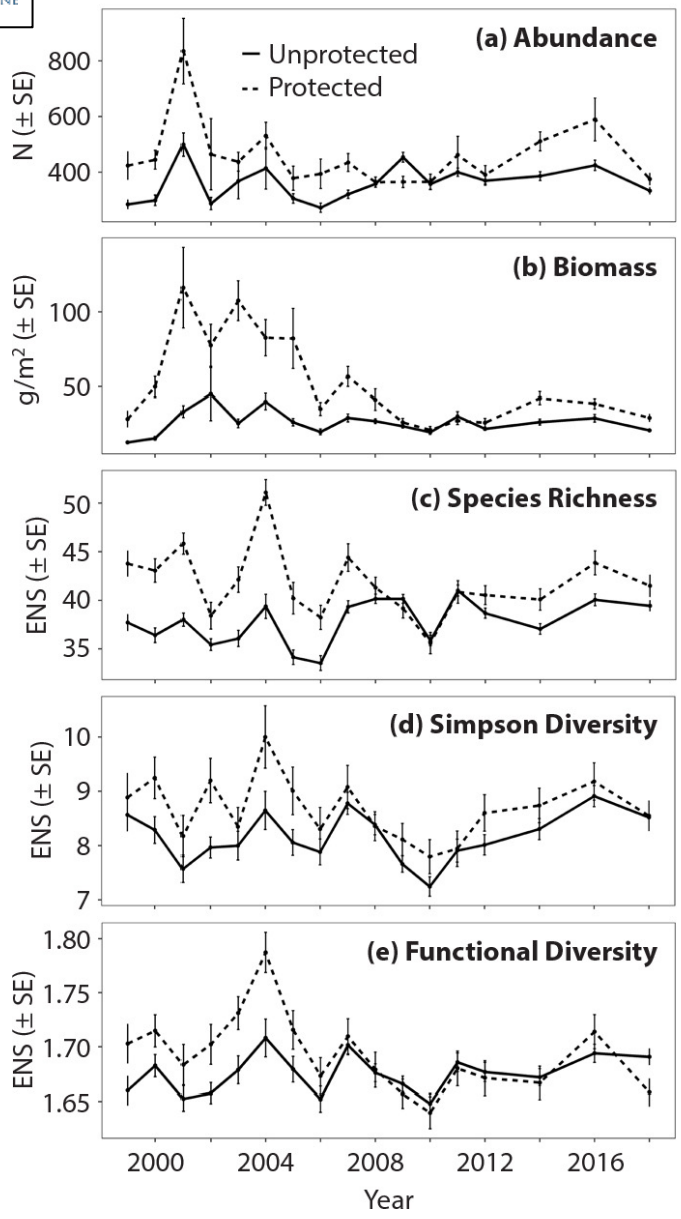


Bottom-up drivers in the Chukchi Sea (green arrows)

South Florida MBON





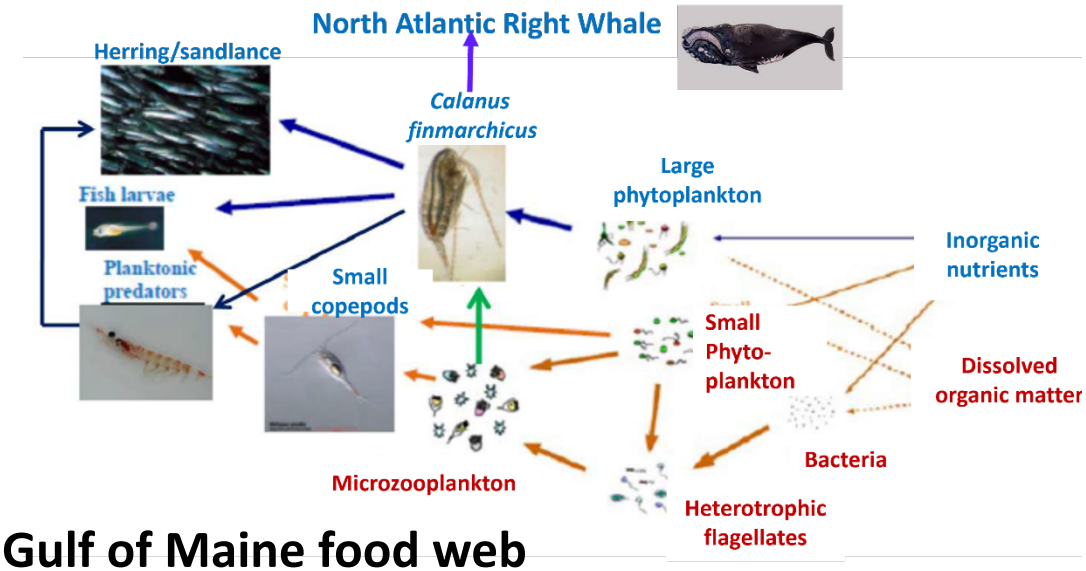


Medina et al., 2021
https://doi.org/10.5670/oceanog.2021.214

Finding:

Diversity difference between protected and unprotected areas has decreased over time

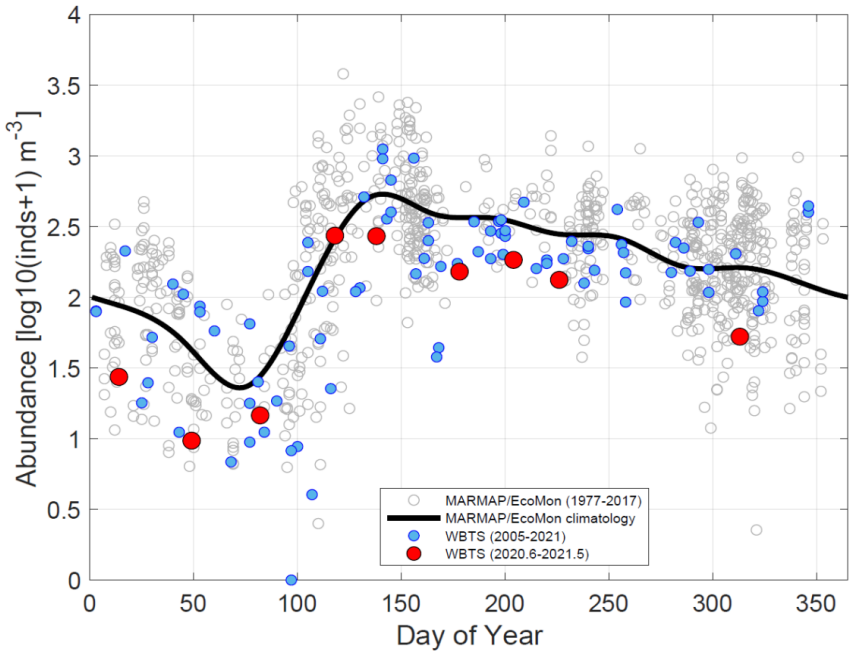
High relief reefs have higher diversity



Gulf of Maine food web

Gulf of Maine MBON

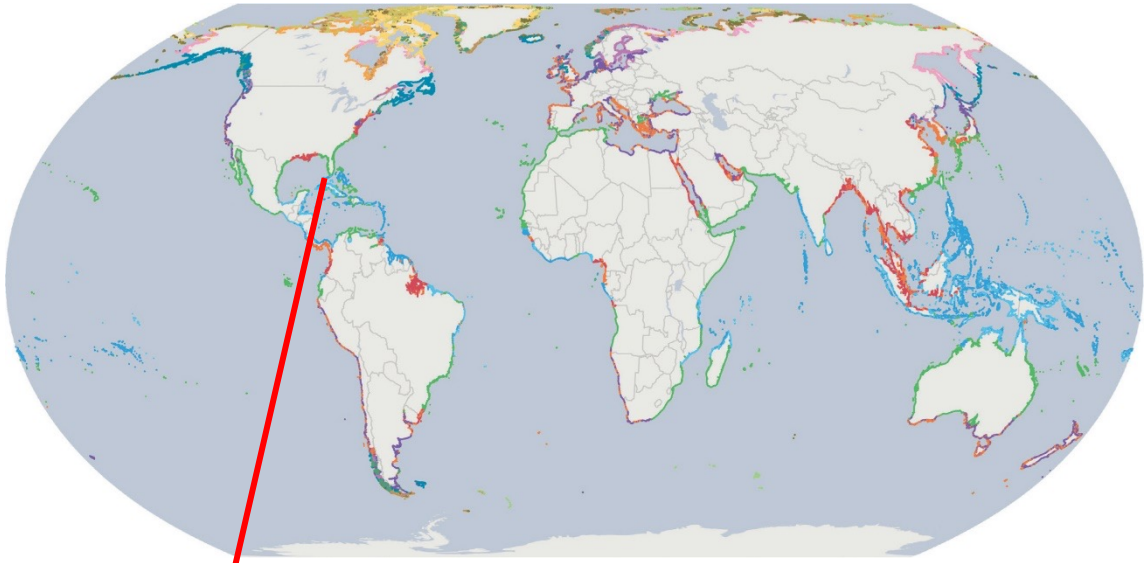
Warming of the Gulf of Maine (GoM) affects valuable fisheries and marine mammals (critically endangered N Atlantic right whales)



The *Calanus* Index. based on monthly measurements of *C. finmarchicus abundance*, W Gulf

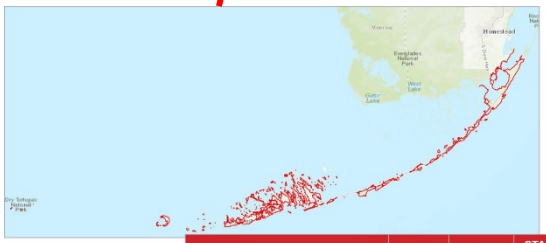
Abundance levels now 30-50% of historical levels in late summer through winter. [y-axis is log scale](Ji et al. 2021 and GoM MBON data).

Global Efforts



Distribution of 16 groups of similar coastlines

Sayre et al., 2021
https://doi.org/10.5670/oceanog.2021.219



VARIABLE	MEAN	MEDIAN	STANDARD DEVIATION	RANGE	PREDOMINANT CLASS (% OF SEGMENTS)
Slope (%)	8.84	4.52	11.25	100.08	Flat (71)
Sinuosity (unitless)	10.66	1.41	98.18	1212.32	Straight (53)
Erodibility	NA	NA	NA	NA	Low (94)
Temperature and Moisture Regime	NA	NA	NA	NA	Tropical Moist (94)
River Discharge (unitless)	0.0002	0.00002	0.0005	0.002	Moderate River Discharge (70)
Wave Height (m)	0.41	0.41	0.16	0.48	Low Wave Energy (68)
Tidal Range (m)	1.00	1.02	0.25	1.21	Moderately Tidal (52)
Marine Physical Environment	NA	NA	NA	NA	Euhaline-Oxic-Warm (100)
Turbidity (m^{-1})	0.27	0.19	0.20	0.53	Clear (41)
Chlorophyll ($\mu g\ L^{-1}$)	2.30	2.28	0.45	3.71	Moderate Chlorophyll (69)

Coastline characteristics of the Florida Keys National Marine Sanctuary (Florida Keys US MBON site)

Output:
CSU - Coastal Segment Units

Coastal and Marine Ecological Classification Standard (CMECS) labels for global coastal segments at 1 km

Output:

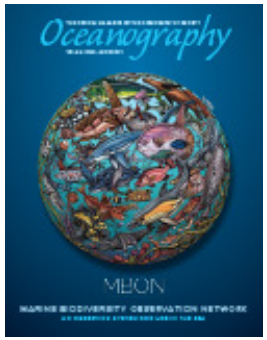
MBON and OBIS/GBIF collaboration

Mapping data flow: collection to publication

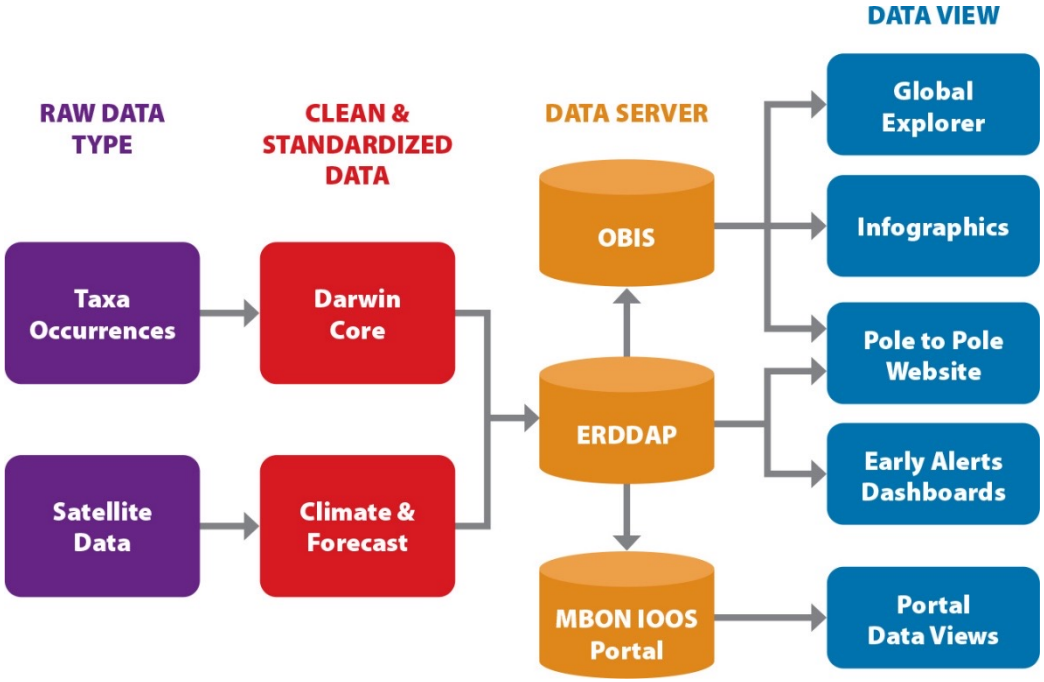
Examples:

- Rockfish (California/Pacific)
- Reef fish (Florida keys/Atlantic)
- Satellite data (early alert dashboards)
- Pole to Pole Data Viewer
- IOOS MBON Portal

Data Management and Interactive Visualizations



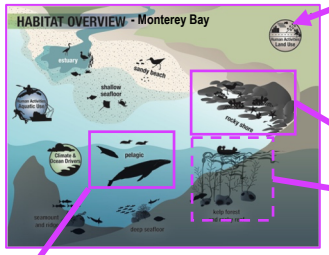
Benson et al., 2021
https://doi.org/10.5670/oceanog.2021.220

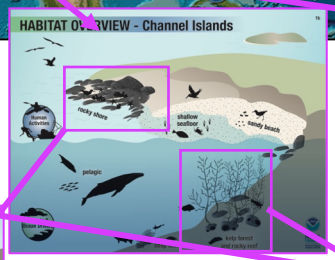


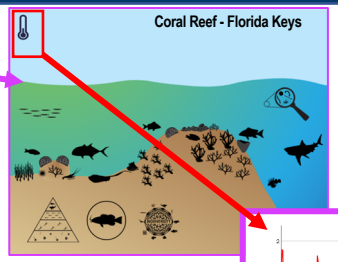
Addressing Sanctuary Needs: data tools

Processes and products being shared across programs and regions

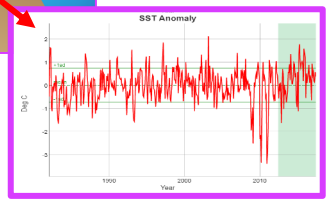
Collaboration between sanctuaries, IEA, MBON expanding to Gulf of Mexico



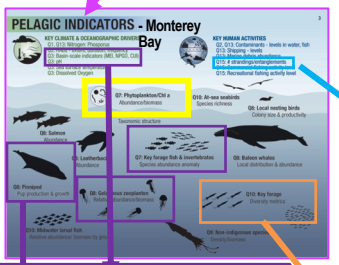


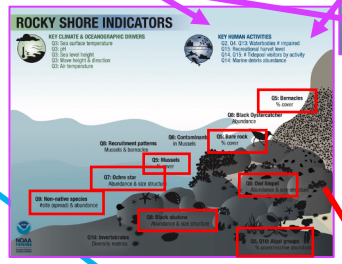


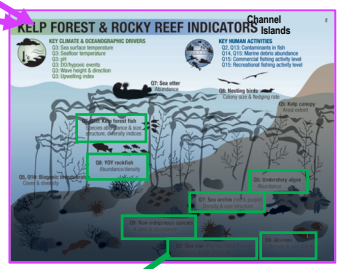
Currently conceptual models and data products under Development by Sanctuaries MBON

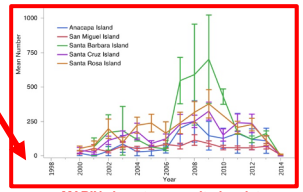


Gulf of Mexico IEA meeting with FKNMS, including Sanctuaries MBON partners, to expand collaboration apply IEA products and processes to the sanctuary.

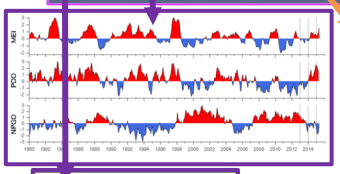


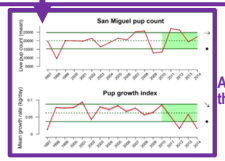




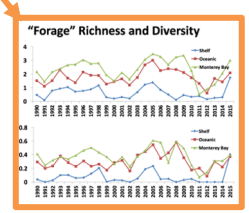


MARINe long-term monitoring data

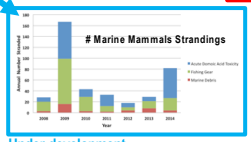




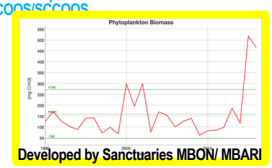
Available through CCIEA



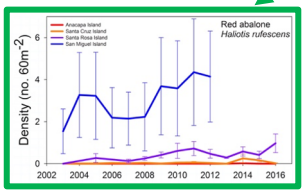
Developed by Sanctuaries MBON



Under-development CeNCOOSISCCOOS



Developed by Sanctuaries MBON/ MBARI



PISCO / CINP / LTER data

Collaboration of IEA with

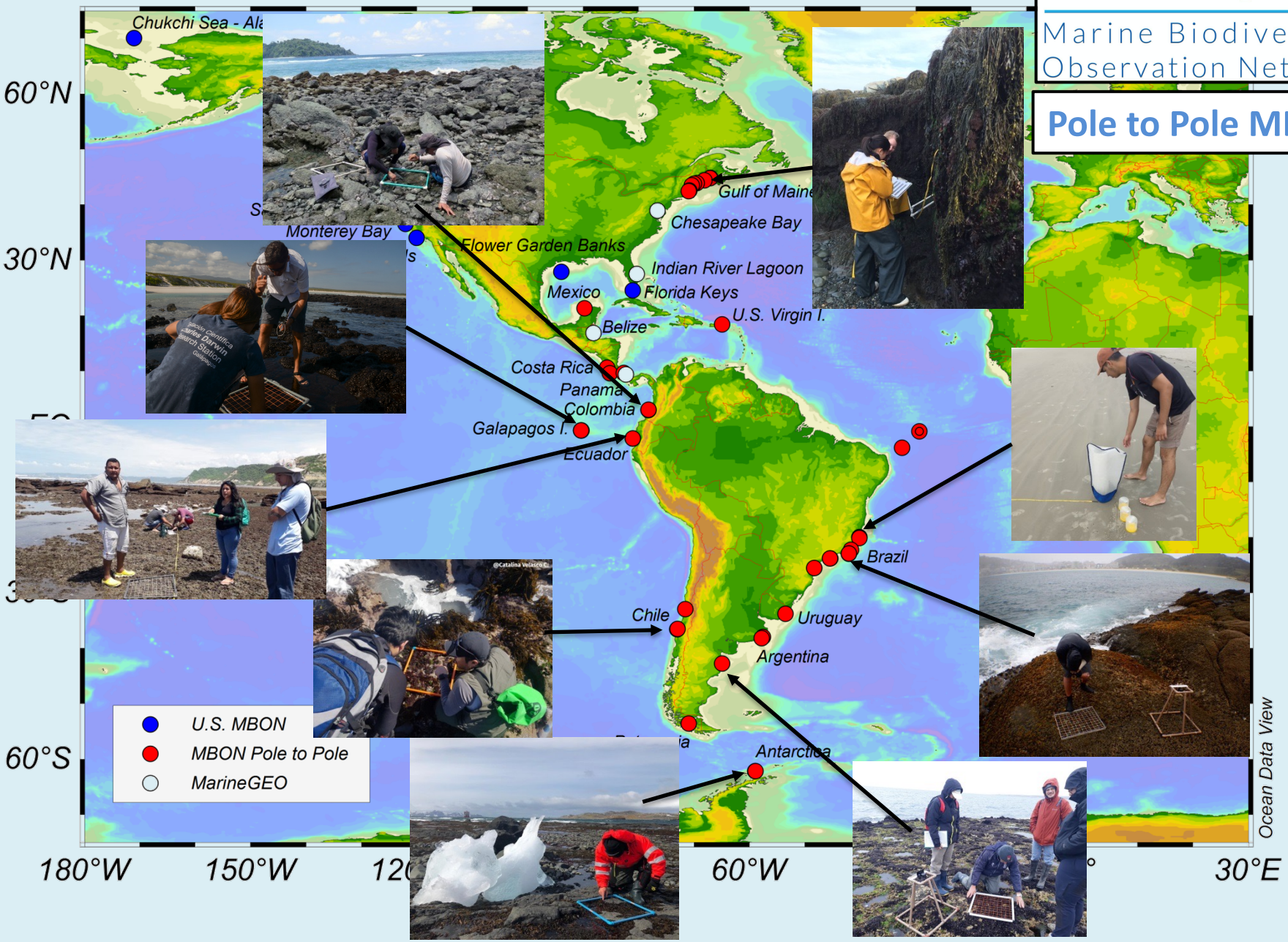
MBON Marine Biodiversity Observation Network

U.S. MBON PORTAL

Capacity Building – Field sampling

MBON
Marine Biodiversity Observation Network

Pole to Pole MBON



Pole to Pole MBON

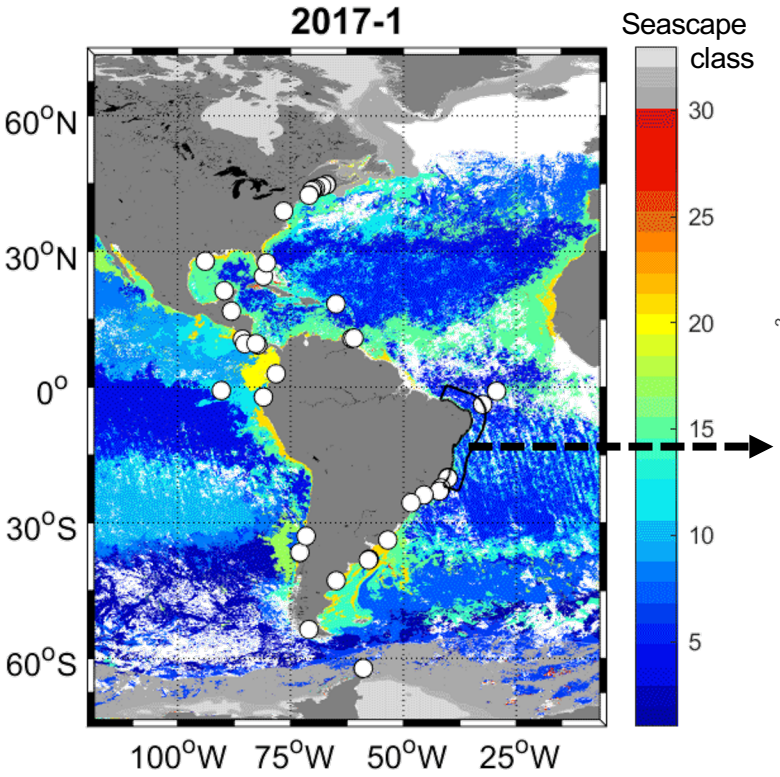
MBON
Marine Biodiversity Observation Network

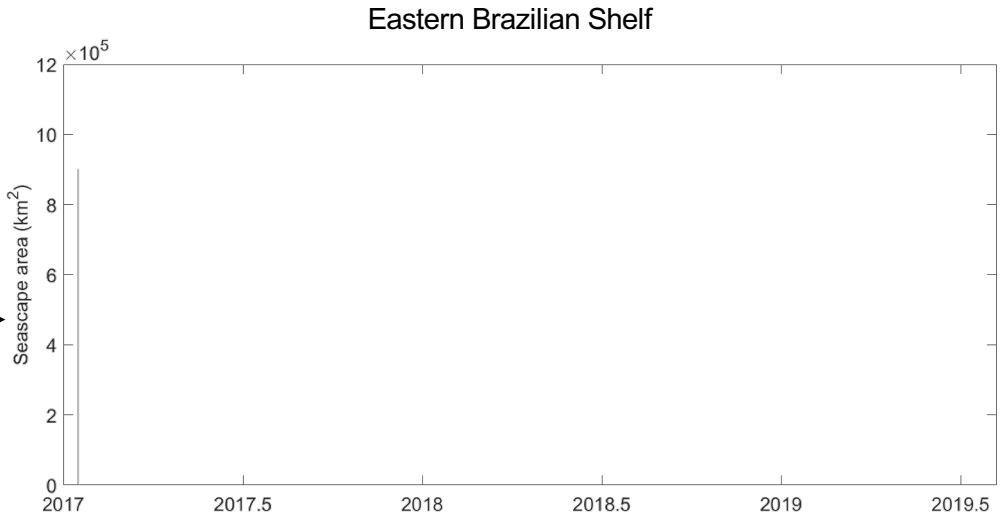
GEO BON

OSU
Oregon State University
College of Earth, Ocean, and Atmospheric Sciences

Developing Essential Biodiversity Variables (EBVs)

Global classification of surface waters at 5 km pixel res.





"Ecosystem Extent" EBV using satellite-derived seascape maps

Capacity Building – Field and satellite data / applications

2021 2030 United Nations Decade of Ocean Science for Sustainable Development

Challenge 2:
Develop solutions to ecosystem stressors

Challenge 9:
Develop capacity and equitable access

Challenge 10:
Understand values and services, humanity's relationship with ocean

Marine Life 2030

Our Partners

And a long list of academic and government partners

https://marinelife203

Thank You!

Frank Muller-Karger
carib@usf.edu

http://marinebon.org

#MarineLife2030

https://marinelife2030.org/

UNIVERSITY OF SOUTH FLORIDA
College of MARINE SCIENCE